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Reading Comprehension: Core Components and Processes

Panayiota Kendeou[1], Kristen L. McMaster[1], and Theodore J. Christ[1]

Abstract

Reading comprehension is multidimensional and complex. The persistent challenges children, adolescents, and even adults face with reading comprehension call for concerted efforts to develop assessments that help identify sources of difficulties and to design instructional approaches to prevent or ameliorate these difficulties. Doing so requires drawing on extant research to understand the core components and processes of reading comprehension. This article reviews the theoretical and empirical literature on the construction of meaning during reading comprehension and derives implications for research, practice, and policy related to instruction and assessment. We focus specifically on the inferential processes that extract meaning from text and the sources of knowledge that facilitate the extraction and construction of meaning.

Keywords

reading comprehension, inferential processes, background knowledge, meaning construction

Tweet

Focusing on inferential processes and background knowledge can prevent or ameliorate persistent reading comprehension difficulties.

Key Points

- Reading comprehension is complex, and a clear understanding of its component processes is necessary to effectively and efficiently address difficulties.
- Theoretical models of reading comprehension specify inferential processes and background knowledge as integral components.
- Advances in the development of assessments and interventions that address inferential processes and knowledge show great promise.
- Much more work is needed to determine how best to prevent and ameliorate reading comprehension difficulties and close achievement gaps.

Introduction

Educators, researchers, and policy makers have exerted persistent efforts over the last 60 years to improve reading performance among children in the United States (e.g., Alexander & The Disciplined Reading and Learning Research Laboratory, 2012; Common Core State Standards [CCSI] Initiative, 2010; Connor et al., 2014). Nonetheless, 44% of fourth-grade and 46% of eighth-grade children failed to meet the standards for reading proficiency on the most recent Nation's Report Card (National Assessment of Educational Progress, 2015). Results for nonmajority groups are particularly troubling. For example, Black children in fourth grade performed an average of 26 points lower than their White counterparts, and similar discrepancies were evident for other minority groups. These unacceptable educational disparities between expected performance and actual achievement must be addressed.

Proficient reading in fourth grade requires students to make simple inferences, draw conclusions, and make evaluations about the texts they read. Proficient reading in eighth grade requires students to make simple inferences, connect parts of the text, and substantiate judgments about text content. Thus, the standards for reading performance reach beyond the fundamental aspects of reading (i.e., word reading and fluency; Ehri, 2014) to include the identification and use of meaning in both its explicit and implicit forms. Students who do not meet these standards fail to derive and use the overall meaning of text. In part, they fail to perform the fundamental *inferential processes that construct meaning* while reading, and if meaning is not constructed *during* reading, then it is also not a product once reading is complete (Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007).

[1]University of Minnesota, Minneapolis, MN, USA

Corresponding Author:
Panayiota Kendeou, Department of Educational Psychology, University of Minnesota, 56 East River Road, Minneapolis, MN 55455, USA.
Email: kend0040@umn.edu

Students who experience such difficulties are likely to struggle throughout their education and employment (Snow, 2002), as basic reading proficiency is necessary for mastering deeper comprehension, learning, and other 21st century skills (Goldman & Pellegrino, 2015; Graesser, 2015).

This article reviews the theoretical and empirical literature on the construction of meaning during reading comprehension, and derives implications for research, practice, and policy related to instruction and assessment. While we acknowledge the foundational skills of word reading accuracy and fluency, our specific foci are the inferential processes that extract meaning from text and the background knowledge that facilitates the extraction and construction of meaning.

Reading Comprehension

Reading comprehension is among the most complex human activities. To understand this sentence, for example, one must visually process the words; identify their phonological, orthographic, and semantic representations; and connect the words using rules of syntax to understand the underlying meaning of the sentence (Perfetti & Stafura, 2014). Understanding the underlying meaning of each sentence, however, is not sufficient. One must integrate that meaning across sentences, make use of relevant background knowledge, generate inferences, identify the text structure, and take into consideration the authors' goals and motives (Graesser, 2015). The end product is a mental representation that reflects the overall meaning of the text, what has been termed as the *situation model* (Kintsch & van Dijk, 1978). For all of these processes to be successful, many interacting factors are playing a role, such as reader characteristics, text properties, and the demands of the task at hand (Kintsch, 1998; Snow, 2002). This basic level of comprehension is necessary (but not sufficient) for deep learning and developing other 21st century skills (Goldman & Pellegrino, 2015; Graesser, 2015).

The inherent complexity of reading comprehension demands a theory of reading to describe the cognitive and linguistic processes involved, and to make precise, testable predictions. At the same time, this inherent complexity limits our ability to build such a theory with the precision required (Perfetti & Stafura, 2014). As a result, reading and discourse researchers have proposed a number of theoretical models and frameworks that focus on selected components and processes of reading comprehension.

One set of models focuses on *the identification of component skills*, linguistic and cognitive, that explain reading comprehension performance. In this context, several component skills predict reading comprehension, including word decoding (Ehri, 2014), reading fluency (Fuchs, Fuchs, Hosp, & Jenkins, 2001), vocabulary knowledge (Quinn, Wagner, Petscher, & Lopez, 2015), language comprehension (Kendeou, van den Broek, White, & Lynch, 2009; Storch & Whitehurst, 2002), prior knowledge (Kintsch, 1988), comprehension monitoring (Cain, Oakhill, Barnes, & Bryant, 2001), and working memory (Sesma, Mahone, Levine, Eason, & Cutting, 2009). Among the component models proposed, the Simple View of Reading (SVR; Hoover & Gough, 1990), which portrays reading comprehension as the product of decoding and language comprehension, has been extremely influential. In the context of the SVR, *decoding* includes processes needed to decipher written code, such as phonological processing, orthographic processing, and word recognition, whereas *language comprehension* includes processes needed to build a coherent mental representation, such as vocabulary and inference making. The SVR, unlike other more complex component models (e.g., the Direct and Inferential Mediation [DIME] model; Cromley & Azevedo, 2007), is not meant to be comprehensive. Rather, it identifies two of the core components of reading comprehension.

A second set of models[1] focuses on *the identification of various processes* concerned primarily with the construction of the mental representation during reading (see McNamara & Magliano, 2009, for a review). Among these models, the Construction-Integration model (CI; Kintsch & van Dijk, 1978), which describes reading comprehension as the activation and integration of text information and relevant background knowledge into a coherent mental representation (i.e., a situation model), has been extremely influential for researchers and educators alike. In fact, whether one subscribes to the CI model or any other theoretical model or framework, there is consensus that, at its core, reading comprehension involves the construction of a coherent mental representation of the text in the readers' memory. The construction of this representation is accomplished via *inference making* (Kintsch, 1988; P. van den Broek et al., 2005).

Inferences: The Cornerstone of Reading Comprehension

In the context of reading comprehension, an *inference* is information that is retrieved from memory or generated during reading to *fill in* information that is not in a text (Elbro & Buch-Iversen, 2013). Research on inferences has a long history in the field of reading comprehension (O'Brien, Cook, & Lorch, 2015). Reading researchers have examined the conditions under which inferences are generated, the nature and types of inferences readers generate, and the neural correlates of inference generation (Prat, Mason, & Just, 2011). Indeed, inference ability is one of the unique, significant predictors of reading comprehension (Barth, Barnes, Francis, Vaughn, & York, 2015; Cain et al., 2001; Kendeou, Bohn-Gettler, White, & van den Broek, 2008), with some studies indicating a causal link from poor inference making to poor reading comprehension (Oakhill & Cain, 2012).

How do we develop the ability to make inferences? The development of inference skills begins well before formal reading instruction starts (P. W. van den Broek, 1990). For

example, 2-year-olds can generate causal inferences between sequential events (Bauer, 2007), 4-year-olds can generate causal inferences of the events they experience or hear (P. van den Broek, Lorch, & Thurlow, 1996), and 6-year olds can generate causal inferences during comprehension of aurally presented or televised stories (Trabasso & Nickels, 1992). Thus, even very young children engage in inferential processes to comprehend the events they experience in their everyday lives. As children get older, they generate a greater number and wider variety of inferences during everyday experiences and through both listening and reading comprehension (P. W. van den Broek, Helder, & Van Leijenhorst, 2013).

The ability to draw inferences is *a general skill*—that is, it is not specific to reading (Gernsbacher, 1990; Kendeou, 2015; Magliano, Loschky, Clinton, & Larson, 2013). For example, 4- to 8-year-old children's inference skills across aural, televised, and written stories predicted overall reading comprehension performance longitudinally, *independent of the media factor* (Kendeou et al., 2008). Similar findings for adults comprehending stories they listened to, read, or viewed (nonverbal picture stories) made the case for *a general comprehension skill* (Gernsbacher, Varner, & Faust, 1990).

Interventions for inference processes. While it is clear that inference making is important for comprehension, what is less clear is whether inference making *improves* as a result of intervention. Over the last 40 years, researchers have addressed this question, by examining an array of approaches that show promise to promote inference making in the service of reading comprehension. Four decades of intervention studies (McMaster & Espin, 2015) have identified several instructional approaches that show promise for improving inference making, including (a) preteaching activities designed to activate background knowledge and direct students' attention to important parts of text; (b) systematic questioning about key parts of text, with feedback; (c) teaching specific strategies such as looking for clues and thinking aloud; (d) self-questioning; and (e) using graphic models to fill in gaps in text, as needed to make inferences.

This research is promising. However, many studies demonstrated positive effects mainly on measures closely tied to intervention (e.g., answers to inferential questions on researcher-designed measures). Fewer studies demonstrated that improved inferencing skills led to constructing more coherent representations of text (e.g., improved text recalls). Fewer still demonstrated effects on more generalized measures of reading comprehension (e.g., standardized reading tests). In addition, effects observed in relatively brief intervention studies may or may not maintain over time. Other remaining questions include the following: "Which approaches show promise and why?" "For *whom* are inference instruction approaches most beneficial, and under what conditions?" and "Can these approaches be implemented in ways that lead to meaningful improvement in reading comprehension?"

Furthermore, if inference making is a general skill (Gernsbacher, 1990; Kendeou, 2015; Magliano et al., 2013), this opens up the possibility of developing instructional approaches that can support the development of inference skills in the context of language comprehension, and its subsequent transfer in reading comprehension. Future research is needed to develop and evaluate the efficacy of such instructional approaches.

Policy implications regarding inference interventions. Thanks to funding from federal agencies, such as the Institute of Education Sciences (IES) and the National Institute of Child Health and Human Development (NICHD), a number of comprehension-focused instructional approaches are currently under development and testing. One such approach, called "In-the-Text Connections" (McMaster et al., 2015), draws from cognitive models of reading to support struggling fourth-grade readers' use of text-based inferences to comprehend narrative and informational text. Specifically, readers read and answer "causal" questions designed to direct readers' attention to highly connected events that are necessary for understanding important causal relations within a text. An active ingredient in this intervention is "scaffolded" feedback designed to prompt students to use the text to answer the questions. Preliminary evidence suggests that such a questioning approach improves students' comprehension of specific texts (McMaster et al., 2012); however, further research is needed to help students transfer these inference-making skills to a broader range of texts.

This intervention illustrates an approach that attempts to address the needs of students already identified as experiencing reading comprehension difficulties. However, as mentioned earlier, such intervention approaches have yielded limited effects on generalized comprehension. While further intervention work is needed, evidence that inference-making skills develop well before formal reading instruction begins (Bauer, 2007; Trabasso & Nickels, 1992; P. van den Broek et al., 1996) suggests an opportunity for *prevention* of later comprehension difficulties. Preventative instruction focusing on language comprehension in young children, including inference making as a general language skill, may serve to circumvent later reading comprehension difficulties (National Early Literacy Panel, 2008).

Assessment of inference processes. Engaging in inference making to construct a mental representation of what the text is about is the *process* of reading comprehension, whereas the mental representation itself is the *product* of reading comprehension. Distinctions between the processes and product are important for interpreting and using assessment outcomes. The mental representation is of interest for some interpretations and uses, but certainly not all. The processes

used to construct meaning are often of more interest than the product (Rapp et al., 2007) because they can help discern *why* the intended meaning or mental representation was not evident at the conclusion of a reading activity.

In turn, the purpose of assessment guides the selection of an assessment tool, along with the interpretation and use of the assessment outcome. Two broad purposes are summative and formative evaluation (Scriven, 1967). *Summative evaluation* is used to discern the state of achievement, which summarizes performance at a particular point in time. For example, students either meet or do not meet standards for reading proficiency. Whether they do or not does not provide substantial insight as to how to promote improved performance in the future. In contrast, *formative evaluation* is used to discern the needs of a student with respect to instruction and curriculum to improve achievement. Taking these two purposes of assessment, the assessment of the reading product might be of interest for summative evaluation, but the reading processes might be of more interest for formative evaluation. Until recently, few, if any, efficient and useful measures tapped the inferential processes that are used to construct meaning (Afflerbach, Cho, & Kim, 2015). The vast majority of tools target the product rather than the processes, which limits their utility for formative evaluation.

A few notable technologies are emerging, however, that might make processes-focused assessments more efficient and easy to use. For example, Comprehension Efficiency (COMPreading; FastBridge Learning, 2015) is a cloud-based measure of both reading processes and products. Students read a passage, one sentence at a time, while their reading time is recorded. The passage is intermittently interrupted by a series of true–false questions designed to measure inferential processes. At the conclusion of the passage, the student responds to a set of multiple-choice questions designed to evaluate the quality of their mental representation. The student's response accuracy and reading times, taken together, indicate the accuracy and efficiency of the reading processes. Preliminary evidence of reliability and validity were promising at the time of this publication (Christ & White, 2015). The Reading Strategies Assessment Tool (RSAT; Magliano, Millis, the RSAT Development Team, Levinstein, & Boonthum, 2011) functions in a similar manner, but it uses open-ended questions that are either general (e.g., "What are you thinking now?") or specific (e.g., Why, Who, What questions), and it automatically scores the accuracy of the reader's open-ended typed responses to identify basic inferential processes. The Multiple-Choice, Open-Ended, Cloze, Comprehension Assessment (MOCCA; Carlson, Seipel, & McMaster, 2014) also targets inferential processes. Students read short texts, in which a sentence is deleted before the last sentence of the text. Participants choose one of four sentences to complete the deleted line from each text. Patterns in response types provide diagnostic information about the reading processes students engage to comprehend the text. Finally, the Bridging Inferences Test (Bridge-IT; Barth et al., 2015) combines these procedures. Students read a set of sentences and judge whether a continuation sentence is consistent or inconsistent with prior text. As with COMPreading, the accuracy and response times assess the inferential processes during reading. These measures demonstrate some innovative work that holds promise.

Policy implications regarding assessment of inference. Federal agencies (e.g., IES) provide competitive funding for the research and development of assessment tools. These investments have resulted in the development of the innovative tools discussed above, and ongoing support for such work makes innovation possible. In addition to research and development for measuring inferential processes, some of that work helps to guide multiple measures to inform instruction. Researchers and educators need both access to and guidance for the use of such measures. As a case example, the Office of Special Education Programs (OSEP) currently funds a large grant for research and development to scale-up the Formative Assessment System for Teachers (FAST), which includes measures of reading achievement (e.g., concepts of print, phonological awareness), measures of word identification and automaticity, broad measures of reading achievement, and COMPreading. That work and related work funded by IES contributes to the use of innovative measurement tools among researchers and educators.

IES also funds other projects, which include a substantial investment through the Race to the Top Assessment (RTTTA) program that included two assessment consortia. Those consortia brought together public and private partners for research and development to establish common high-stakes testing programs for the nation: third to eighth and high school (SMARTER Balanced Assessment Consortium [SBAC]), and third to eleventh (Partnership for the Assessment of Readiness for College and Careers [PARCC]). These programs focus on summative assessment, and neither emphasizes the inferential processes emphasized here. More funding is needed for formative assessments, especially those diagnosing processes-related causes of comprehension failures.

Knowledge: The Necessary Source for Reading Comprehension

The factor that carries the largest variability in reading comprehension is the reader's knowledge. At various levels of the reading comprehension process, the reader draws on *different sources of knowledge*. Three such sources (Perfetti & Stafura, 2014) include linguistic knowledge (about phonology, syntax, and morphology), orthographic knowledge (about the orthographic system), and general knowledge (about text structure and the world). This latter source, general knowledge, relates to academic language (Snow, 2010),

which includes academic knowledge (taught in the curriculum) and vocabulary. Reading researchers have highlighted the critical role of these knowledge sources in several aspects of reading, including word decoding (Priebe, Keenan, & Miller, 2012), sentence processing (Barnes et al., 2015), inference making (Cain et al., 2001; Singer, 2013), comprehension monitoring (Connor et al., 2015), and overall text comprehension (McNamara & Kintsch, 1996).

General knowledge can both facilitate and disrupt reading comprehension. The facilitative influences of prior knowledge have been demonstrated in the comprehension of more and less knowledgeable readers (Alexander & Murphy, 1998), as well as experts and novices in a domain. These studies have highlighted that experts are better, faster, and more accurate than novices when they read texts related to their area of expertise (Chi, 2006). Expert-novice and high-low knowledge reader differences also occur in inference generation (McNamara & Kintsch, 1996).

Although high levels of accurate knowledge can facilitate reading comprehension, inaccurate knowledge can severely disrupt reading comprehension (Kendeou & O'Brien, 2015; Rapp & Braasch, 2014). Readers with inaccurate knowledge generate incorrect inferences during reading and come away with impoverished mental representations of the texts they read (Kendeou & van den Broek, 2005, 2007; P. van den Broek, 2010). These findings raise questions about how to leverage reading comprehension not only to acquire knowledge but also to revise knowledge. Knowledge revision during reading appears likely if the texts explicitly refute and explain incorrect knowledge (Braasch, Goldman, & Wiley, 2013; Kendeou & O'Brien, 2014; Sinatra & Broughton, 2011).

Interventions for knowledge. Despite the convergence on the critical role of knowledge in reading, text and general knowledge only recently received attention as an *integral part* of reading comprehension instruction (Cervetti & Hiebert, 2015; Compton, Miller, Elleman, & Steacy, 2014). With respect to text-structure knowledge, instructional programs that were designed to teach students to recognize different text structures, and thus facilitate acquiring and applying text-structure knowledge during reading, showed considerable promise (Meyer et al., 2010; Williams et al., 2014). Notably, much of this work involves elementary schoolchildren and focuses on teaching specific informational text structures, such as cause–effect, compare–contrast, and problem–solution. Although important, it has yet to address the reality of most texts students encounter, namely, mixed or multiple text structures.

Instructional programs designed *specifically* to facilitate knowledge building are far less common; instead, knowledge building is often a subcomponent of reading comprehension instruction. Perhaps this is because of the interdependency between reading comprehension and acquiring knowledge from text; the processes involved in reading comprehension parallel those in learning from text (Goldman, 2012; Kintsch, 1998). For example, the Promoting Adolescents' Comprehension of Text (PACT) intervention, designed to improve content knowledge in social studies, also improved reading comprehension (Vaughn et al., 2013). Similarly, the Content Area Literacy Intervention (CALI), designed to improve science literacy, also improved students' science knowledge (Connor et al., 2014). These bidirectional effects further support the need to consider knowledge as an integral part of reading comprehension instruction.

Policy implications regarding knowledge. Recent initiatives, such as the CCSS Initiative (2010), have posed greater demands for the systematic integration of various knowledge sources into reading instruction and assessment. Text knowledge, for example, becomes critically important, as the expectations are for 50% of the elementary grades curriculum and 70% in the secondary grades to include informational texts. In light of these demands, we need to explore innovative and effective ways to expose students of all ages in various text genres. Using technology and different media may be particularly helpful.

Domain knowledge also becomes increasingly important in disciplinary literacy initiatives (Shanahan & Shanahan, 2008). The focus here is not only to acquire content knowledge from text but also to use processes and knowledge specific to the discipline to construct meaning from disciplinary texts. Thanks to funding from federal agencies, a number of ongoing projects have begun to address this issue. For example, the project READI (Goldman et al., 2015) aims to develop instructional interventions that support adolescent learners' reading for understanding in literary analysis, history, and science. An open question for this line of work is for *whom* disciplinary instruction is the most beneficial and *under what conditions*. More research, and thus funding, needs to address this issue.

Assessment of knowledge sources. No assessment is without its limitations, and reading comprehension is an especially complex domain, which poses unique challenges (Fletcher, 2006). As discussed, general knowledge is a necessary source for inferential processes to unfold and enable reading comprehension. Assessment should decipher whether low performance is due to lack of knowledge, lack of knowledge accessibility, or failure of knowledge integration, and thus the inference process itself. Considering these factors can yield a purer measure of the inferential process during reading.

Indeed, prior knowledge has been traditionally controlled in the assessment of reading to achieve a "purer" reading outcome. One such control manipulated the content domain to reduce knowledge demands. For example, Indonesian history would likely be rare academic knowledge for students in the United States. Another such control included artificial knowledge in the test items (Francis et al., 2006) or narrative rather than informational texts, which provide more opportunities to present information that is substantially unique to the specific narrative.

However, integrating prior knowledge in reading assessments is consistent with defining comprehension as the construction of meaning from both text *and* background knowledge. Thus, such integration might improve the measures' validity (Pearson & Hamm, 2005). This issue is not yet resolved, as only recently has prior knowledge been considered as an *integral part* of assessment (Keenan, 2012; J. Sabatini, O'Reilly, & Albro, 2012). Integrating prior knowledge could be done with a test design that includes text content that does relate to students' prior knowledge.

Policy implications regarding assessment of knowledge. The Reading for Understanding IES initiative currently funds the development of the Global, Integrated Scenario-Based Assessment (GISA; Sabatini, O'Reilly, Halderman, & Bruce, 2014), a web-based measure of reading literacy ability that requires students to read a range of sources to attain specific reading goals. GISA coherently integrates prior knowledge assessment with a test of CCSS Tier 3-type vocabulary words, which have "specificity and close ties to content knowledge" (CCSS Initiative, 2010, Appendix A, p. 33). Despite its innovative approach, GISA is designed to assess a broader reading comprehension construct, rather than specific core processes. Thus, more funding is needed to develop process-focused assessments for core processes, such as inference making, that also coherently integrate relevant prior knowledge.

Concluding Remarks

Reading comprehension is a complex domain and a source of great difficulty for many readers. Given the importance of reading comprehension to academic achievement and lifelong success—and particularly to closing achievement gaps—efforts must continue to prevent and ameliorate reading comprehension difficulties. Theoretical frameworks that specify critical components, including inferencing and prior knowledge, provide a robust basis for developing assessments and instructional approaches aimed at improving reading skills. Researchers have made significant progress in recent years, and with continued support through federal funding, great advances will continue to reveal solutions to reading comprehension problems.

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Note

1. These models include the Construction-Integration model, the Landscape Model, the Structure Building Model, the Resonance Model, the Event-Indexing Model, the Causal Network Model, the Constructionist Model, the Interactive-Compensatory Model, and the Reading Systems Framework.

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